

**STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION**

**2800 BERLIN TURNPIKE, P.O. BOX 317546
NEWINGTON, CONNECTICUT 06131-7546**



Phone: 860-594-3128

November 21, 2014

Subject: Project No. 431-0006

F.A.P. No. CT-90-X523

Waterbury Bus Maintenance Facility Replacement in the Town of Watertown.

NOTICE TO CONTRACTORS:

This is to notify all concerned and especially the prospective bidders that the bid opening for the subject project is still scheduled for December 3, 2014 at 2:00 P.M. in the Conference Room of the Department of Transportation Administration Building, 2800 Berlin Turnpike, Newington, Connecticut.

Addendum No. 5 is attached and can also be obtained on the Statewide Contracting Portal at http://www.biznet.ct.gov/scp_search/BidResults.aspx?groupid=64

This Addendum is necessary to revise a contract documents.

Pre-Bid Questions and Answers: Questions pertaining to DOT advertised construction projects must be presented through the CTDOT Pre-Bid Q and A Website. The Department cannot guarantee that all questions will be answered prior to the bid date. **PLEASE NOTE - at 12:01 am, the day before the bid, the subject project(s) being bid will be removed from the Q and A Website, Projects Advertised Section, at which time questions can no longer be submitted through the Q and A Website. At this time, the Q and A for those projects will be considered final, unless otherwise stated and/or the bid is postponed to a future date and time to allow for further questions and answers to be posted.**

Philip J. Melchionne

For: Gregory D. Straka

Contracts Manager

Division of Contracts Administration

NOVEMBER 21, 2014
WATERBURY BUS MAINTENANCE FACILITY REPLACEMENT
FEDERAL AID PROJECT NO. CT-90-X523
STATE PROJECT NO. 431-006
TOWN OF WATERTOWN

ADDENDUM NO. 5

SPECIAL PROVISIONS

REVISED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety and replaced with the attached like-named Special Provisions:

- NOTICE TO CONTRACTOR – LIQUIDATED DAMAGES
- NOTICE TO CONTRACTOR – PROJECT PHASING REQUIREMENTS
- NOTICE TO CONTRACTOR – UTILITY SERVICE CONNECTIONS AND RELOCATIONS

CSI FORMATTED SPECIAL PROVISIONS

REVISED CSI SECTIONS

The following CSI Sections are hereby deleted in their entirety and replaced with the attached like-named CSI Sections:

- DIVISION 09 – SECTION 096519 – RESILIENT TILE FLOORING
- DIVISION 10 – SECTION 101400 - SIGNAGE
- DIVISION 23 – SECTION 233113 – METAL DUCTS

PLANS

REVISED PLANS

The following Plan Sheets are hereby deleted and replaced with the like-numbered Plan Sheets:

| <u>SHEET NO.</u> | <u>DRAWING NO.</u> | <u>DRAWING TITLE</u> |
|------------------|--------------------|---------------------------------|
| 02.001.A5 | G-003 | INDEX OF REVISIONS |
| 08.003.A5 | AS-101 | GROUND FLOOR SIGN LOCATION PLAN |
| 08.004.A5 | AS-102 | FIRST FLOOR SIGN LOCATION PLAN |
| 08.005.A5 | AS-103 | SECOND FLOOR SIGN LOCATION PLAN |

| <u>SHEET NO.</u> | <u>DRAWING NO.</u> | <u>DRAWING TITLE</u> |
|------------------|--------------------|------------------------------------|
| 08.007.A5 | AS-202 | SIGNAGE DETAILS |
| 10.016.A5 | P-114 | SANITARY FIRST FLOOR PLAN – AREA B |

The Bid Proposal Form is not affected by these changes.

There will be no change in the number of calendar days due to this Addendum.

The foregoing is hereby made a part of the contract.

JULY 30, 2014
STATE PROJECT NO. 0431-0006
FEDERAL AID PROJECT NO. CT-90-X523

WATERBURY BUS MAINTENANCE FACILITY REPLACEMENT

Town of Watertown
Federal Aid Project No. CT-90-X523

The State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004, as revised by the Supplemental Specifications dated January 2014 (otherwise referred to collectively as "ConnDOT Form 816") Division I, General Requirements and Covenants and Division III, Materials Section; exclusive of references to Method of Measurement and Basis of Payment is hereby made part of this contract, as modified by the Special Provisions contained herein. The State of Connecticut Department of Transportation's "Construction Contract Bidding and Award Manual" ("Manual"), May 14, 2010 edition or latest issue, is hereby made part of this contract. If the provisions of this Manual conflict with provisions of other Department documents (not including statutes or regulations), the provisions of the Manual will govern. The Manual is available upon request from the Transportation Manager of Contracts. The Special Provisions relate in particular to the Construction of a Bus Maintenance Facility in the Town(s) of Watertown.

CONTRACT TIME AND LIQUIDATED DAMAGES - BUS MAINTENANCE FACILITY

Seven hundred and fifty (750) calendar days will be allowed for completion of the work on this project and the liquidated damages charge to apply will be Nine Thousand One Hundred Dollars (\$9,100.00) per calendar day.

In addition to the above requirements, the following additional liquidated damages requirements for this contract exist:

The following durations will be allowed from the Notice to Proceed as outlined below or liquidated damages charges will be enforced and applied at a rate of Two Thousand and Five Hundred Dollars (\$2,500) per calendar day.

1. **Complete Installation of Offsite Pump Station #2– Three Hundred Ninety-Seven (397) calendar days.**

2. **Complete Installation of Onsite Pump Station #1– Four Hundred Twenty-Seven (427) calendar days.**
3. **Complete Installation of Onsite Gravity Sanitary Sewer– Four Hundred Twenty-Seven (427) calendar days.**
4. **Complete Installation of Onsite Sanitary Sewer Forcemain– Four Hundred Twenty-Seven (427) calendar days.**
5. **Complete Installation of Onsite Watermain– Four Hundred Eighty-Eight (488) calendar days.**
6. **Complete Pressure Testing and Disinfection of Onsite Watermain– Five Hundred Fifty (550) calendar days.**
7. **Complete Testing of Onsite Pump Station No.1, Offsite Pump Station No.2, Onsite Gravity Sanitary Sewer and Onsite Sanitary Sewer Forcemain– Five Hundred Eighty (580) calendar days.**

NOTICE TO CONTRACTOR – PROJECT PHASING REQUIREMENTS

Although the Contractor is responsible for developing its own phasing plan for the Engineer's approval for the Project work, the following outline-phasing plan requires certain Project work to be performed during specific time periods:

Phase 1

The Contractor shall:

- A. Begin and complete installation of fencing and gate required to secure the entire Project site.*
- B. Begin and complete Environmental and Safety controls.*
- C. Begin and complete installation of construction trailers where indicated on the drawings. Provide temporary power and communications as required by the contract.*
- D. Begin and complete installation of personnel Restroom trailers including temporary water and sewer as indicated on drawings.*

Phase 2

The Contractor shall:

- A. Begin and complete clearing and grubbing, site layout and rough grading and excavation.*
- B. Begin and complete installation of offsite Pump Station No. 2. See Contract Time and Liquidated Damages.*
- C. Begin and complete installation of the onsite waterline. See Contract Time and Liquidated Damages.*
- D. Begin and complete installation of onsite Pump Station No. 1. See Contract Time and Liquidated Damages.*
- E. Begin and complete installation of onsite gravity sanitary sewer. See Contract Time and Liquidated Damages.*
- F. Begin and complete installation of onsite sanitary sewer forcemain. See Contract Time and Liquidated Damages.*
- G. Begin and complete on-site utilities/ storm drainage.*

Phase 3

The Contractor shall:

- A. Begin and complete foundations and underslab utilities.*
- B. Begin and complete concrete slabs on grade.*
- C. Begin and complete structural steel erection and composite flood construction.*
- D. Begin and complete exterior envelope.*

Phase 4

The Contractor shall:

- A. Begin and complete interior partitions.*
- B. Begin and complete mechanical, electrical and plumbing rough-ins.*
- C. Begin and complete setting mechanical equipment.*
- D. Begin and complete bus equipment and lifts.*
- E. Begin and complete mechanical, electrical and plumbing fixtures.*
- F. Begin and complete interior finishes and signage.*

Phase 5

The Contractor shall:

- A. Begin and complete start-up/ commissioning.*
- B. Complete necessary sanitary sewer forcemain, pump stations (s) and waterline testing including but not limited to hydrostatic and bacteriological. See Contract Time and Liquidated Damages.*
- C. Begin and complete punch-list.*
- D. Substantially completion.*

Phase 6

The Contractor shall:

- A. Begin and complete close-out procedures.*
- B. Final completion.*

The Engineer will hold a Semi-Final Inspection for the Project. Once the Department personnel have permanently reoccupied the building, the Contractor shall remove the temporary facilities as described in Form 816 Article 1.20-1.08.03 and complete any remaining site construction.

NOTICE TO CONTRACTOR – UTILITY SERVICE CONNECTIONS AND RELOCATIONS

The electric, telephone, gas, water (including fire protection), and sewer services to the Project Site require service connections to the applicable utility company's facilities. Utility service connection relocations and installations to the point of the utility service are included as shown and described within the Contract.

The Contractor is responsible for notifying the utility company prior to the need for the utility connection, and for coordinating the service connection and/or relocation requirements with the utility company. The Contractor shall coordinate with the following utility companies:

| | |
|-------------------|------------------------------------|
| <u>Electric:</u> | Connecticut Light and Power – CL&P |
| <u>Telephone:</u> | AT&T |
| <u>Gas:</u> | Yankee Gas |
| <u>Water:</u> | Town of Watertown |
| <u>Sewer:</u> | Town of Watertown |

Where known, utility company representatives are identified elsewhere within the Contract.

Electric

An allowance is included in the Contract to reimburse Connecticut Light and Power – CL&P for the utility's fees and work related to the Project. All Contractors will include the amount of \$21,252.00 for utility service charges in the Contract Bid Price. If it is determined that different charges apply, the Contractor's bid will be adjusted to reflect the differential by construction order, provided that the Contractor provides all applicable written billing documentation. The Contractor will be compensated only for the difference between the billed amount and the estimated amount. No additional Contractor markup will be allowed. The Contractor is responsible for coordinating this work with the utility company and for administrative requirements for reimbursing the utility company.

CL&P will provide and completely install primary electrical cable in conduit provided by contract documents. CL&P will provide and install utility transformer and terminate primary and secondary conductors, transformer pad shall be by contractor. Utility pole at street shall be by utility with riser stub-ups provided by contractor.

Telephone

AT&T will provide and terminate communications cabling to the facility in conduit provided by contractor. AT&T will not charge for this service.

Gas

An allowance is included in the Contract to reimburse Yankee Gas for the utility's fees and work related to the Project. All Contractors will include the amount of \$200,000 for utility service charges in the Contract Bid Price. If it is determined that different charges apply, the

Contractor's bid will be adjusted to reflect the differential by construction order, provided that the Contractor provides all applicable written billing documentation. The Contractor will be compensated only for the difference between the billed amount and the estimated amount. No additional Contractor markup will be allowed. The Contractor is responsible for coordinating this work with the utility company and for administrative requirements for reimbursing the utility company.

Yankee Gas will provide and completely install a new gas main extension to service the site. The gas main will connect to an existing gas main on Waterbury Road (S.R. 848) and will extend along Frost Bridge Road to the entrance to the site.

The gas service line will run from the new gas main at Frost Bridge Road to the point of connection to the building. Contractor will be responsible for trenching and bedding per detail provided on the plans. Yankee Gas will provide the gas service pipe, place it in the trench, and make connections at the main and at the building. The Contractor will then backfill the trench. The Contractor will be responsible for proper disposal of spoils from the installation.

Timing of the work must be closely coordinated with the utility and with the Resident Engineer. Yankee Gas must be notified a minimum of 8-weeks prior to anticipated commencement of the work. Installation must be completed prior to installation of sidewalks, curbing, and pavement but cannot commence until site grading (fill) along the proposed gas service alignment is at or near final grade.

Water

An allowance is not required. The Contractor will be required to have the waterline completed and installed to the location as shown on the plans (approximately at the ROW) prior to the offsite contractor completing the connection to the onsite waterline installed under this contract. Upon completion of the connection to the onsite waterline by the offsite contractor, the Contractor is required to complete all hydrostatic and bacteriological tests as outlined in the contract documents.

Sewer

An allowance is not required. The Contractor will be required to install onsite Pump Station No.1 and offsite Pump Station No. 2. The Contractor will be required to install both the onsite gravity sanitary sewer and forcemain to the location as shown on the plans (approximately at the ROW) prior to the offsite contractor completing the connection to the onsite sanitary forcemain installed under this contract. Upon completion of the connection to the onsite forcemain by the offsite contractor, the Contractor is required to complete all hydrostatic tests, and pump station tests as outlined in the contract documents. This testing is not to be completed until domestic water is available at the site through the waterline connection outline above.

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vinyl composition floor tile.
- B. Related Requirements:
 - 1. Division 01, High Performance Buildings Requirements Section for credits 16a-38k-4(b)4
 - a. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

1.3 ACTION SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For each type of product.
- C. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For Resilient Tile Flooring to include in emergency, operation, and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR - CLOSEOUT DOCUMENTS.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL COMPOSITION FLOOR TILE (VCT-1 and VCT-2)

- A. Basis of Design Product: Subject to compliance with requirements, provide, Armstrong World Industries, Inc.
- B. Tile Standard:
 1. VCT-1: ASTM F 1066, Class 2, through-pattern tile.
 2. VCT-2: ASTM F 2982.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch (3.2 mm).
- E. Size:
 1. VCT-1: 12 by 24 inches (305 by 610 mm).
 2. VCT-2: 12 by 12 inches (303 by 305 mm).
- F. Colors and Patterns:
 1. VCT-1: Raffia; 55802 Charcoal Dust.
 2. VCT-2: Migrations; T3501 Platinum Gray.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Moisture Mitigation System: Two-part cross linked epoxy resin recommended by floor and tile manufacturer to reduce water vapor transmission.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
 - 5. Provide results of moisture testing to Architect, including date of concrete substrate installation and date of testing. If moisture testing does not pass floor tile manufacturers written recommendations, at the direction of the Architect, provide moisture mitigation system and install per manufacturers written recommendations.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.

- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS: The following outlines submittal requirements unique to this section of the work, especially shop drawing content and samples

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS
- B. After award of contract, but prior to the beginning of detailed shop drawings, submit drawings showing typical details of connections. The Contractor shall arrange to meet with Architect and Architect's representative approximately one (1) week after submittal to review drawings and coordinate comments. The typical details as accepted shall be used to control detail design, shop drawing preparation and approval.
- C. Shop drawings:
 - 1. Submit complete shop drawings for manufactured and fabricated items. Indicate materials, layouts, sizes, methods, finishes, footings and anchorage devices, connections and other details of construction, as well as the relation to supporting and adjacent work where applicable. Exact identification of the paint or ink shall be noted on the shop drawings along with method of application. Create and confirm layout conditions not shown on the contract documents.
 - a. Identify all pre-fabricated products proposed for use.
 - b. Indicate manufacturer, brand name, quality and type paint for each surface to be finished.
 - c. Submit complete shop drawings and erection drawings conforming to all current applicable industry standards and local codes. Preparation of shop drawings shall not be sublet without the written permission of Architect.
- D. Details shown are for concept purposes only; the sign contractor shall submit drawings of sign connection details; drawings shall be stamped and computations shall be prepared by a registered professional engineer in the state of Connecticut and shall cover all members, connections (welds, bolts, etc.) indicating such meets the design specifications for sign structures stress requirements and wind load deflection tolerances.
- E. Samples: Submit two samples of each of the following, unless otherwise specified:
 - 1. Finishes:
 - a. Submit 4" x 4" samples of each finish specified. Submit five (5) of each finish.
 - b. Surface-applied graphics shall be on actual substrate upon which they will appear.
 - c. Hardware items: Submit samples of each type of anchor, insert or other fastener as requested by Architect.

- F. Submit for review, approval and demonstration of representative craftsmanship ONE (1) of the following sign types. Sign types shall be an actual sign unit that may be installed on the project site after approval or correction.

- A Monument Sign (representative section only)
- B Building ID Signage (BUS SYMBOL)
- C Bus Entrance ID Letters (1 letter)
- D Employee Entry ID Letters (1 letter)
- E Vehicular Directional Sign (representative section only)
- F Garage Clearance Bar (representative section only)
- G Maintenance Area ID Sign (representative section only)
- H Exterior Door ID Plaque
- I Garage Vehicular Directional Sign (representative section only)
- J Corridor Entrance Graphics (representative section only)
- K Bus Lane ID Sign
- L Elevator Lobby Directory
- M Elevator Cab Directory
- N Restroom ID Plaque
- O Stair ID Plaque
- P Loading Dock ID Sign
- Q General Room ID Plaque
- R Office ID Plaque
- S Bus Bay ID Sign
- T Site Regulatory Sign (post sample and HC Pkg panel only)
- U Administration Area Graphic (representative section only)
- V Building Graphic (representative section only)
- W Dimensional Letters (1 letter)

- G. Submit for review, approval and demonstration of representative craftsmanship ONE (1) of the following sign types to be retained by design team as a control sample.

- C Bus Entrance ID Letters (1 letter)
- D Employee Entry ID Letters (1 letter)
- K Bus Lane ID Sign
- L Elevator Lobby Directory
- N Restroom ID Plaque
- P Loading Dock ID Sign
- R Office ID Plaque

- H. Scheduling: Submit the final schedule for construction of work and installation within ten (10) days of sample approvals. Indicate dates of completion for prototypical units for approval, dates of partial deliveries and total completion. Dates given shall be consistent with the time requirements submitted with the bid.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For the signage identified to include in the operation and maintenance manuals specified in Form 816 Article 1.20-1.08.14 subsection 2 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

- B. Warranty: For signage specified in Form 816 Article 1.20-1.06.08 and described in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Maintain neat, clean conditions in all building areas; remove trash, rags and waste materials at end of each day's work. Protect the floor and wall surfaces of this space against damage or defacement.
- B. Close any open containers at end of day's work. Leave no materials open.
- C. Acrylic and other glazing materials or finish materials with or requiring protective wrapping shall only have this protection removed as required during fabrication and installation and once the area is clear of work or activities which might cause damage to the installed work. Care shall be taken in handling surfaces and products to prevent scratching, chipping, or cracking.
- D. Store materials a minimum of 4" above ground on framework or blocking and cover with protective waterproof covering. Provide air circulation and ventilation. Store in dry, conditioned space.

1.5 QUALITY CRITERIA

- A. Fabricators shall meet the following criteria:
 - 1. Sign contractors and/or subcontractors shall have been regularly engaged in the manufacture, fabrication and installation of sign systems of comparable scope and quality for a minimum of five (5) years.
 - 2. Sign contractors and/or subcontractors shall submit a minimum of five (5) references listing project type, scope of work, Architect and date of completion, Owner's address and telephone number.

1.6 JOB CONDITIONS

- A. Environmental requirements:
 - 1. Comply with manufacturer's recommendation regarding environmental conditions under which materials may be applied.
 - 2. Apply no adhesive or coating materials in spaces where dust is being generated.
- B. Coordination: Coordinate work with the work of other sections of the specifications to ensure that surfaces to receive signs are properly completed, inspected, and approved prior to commencement of work. Commencement of work in any space shall constitute acceptance by the Contractor of surfaces to receive identifying devices.

1.7 WARRANTIES

- A. Warrant vinyl film for a period of five (5) years from Date of Material Completion against delamination from the substrate.
- B. Paints or inks and finishes shall be guaranteed not to cause discoloration, deterioration, or delamination of any materials used in fabrication. Warrant paint finishes on metal and plastic materials for a period of five years from the date of Material completion.
- C. Warranty Provisions: During the warranty period, restore defective work to the standard of the contract documents without cost to the Using Agency, including all labor, materials, refinishing and all costs incidental to the work.
- D. Warrant all electrical components and signs for a period of at least one year, parts and labor, or greater if stipulated elsewhere in the specification section for electrical work.

1.8 GRAPHICS, ARTWORK AND ELECTRONIC FILES:

- A. The Architect or their consultants shall only furnish artwork in an electronic form if it already exists or was created in that form during the course of designing the project. Formats for graphic designs shall be in that of its original creation and may be manual or photo-mechanical or electronic/digital, and if digital, are likely to have been prepared in graphic design industry standard computer software on Macintosh™ platform computer hardware. Contract document drawings or layouts for the work shall not be transferred or transmitted to the contractor.

PART 2 - PRODUCTS

2.1 CUSTOM SIGNAGE

Provide architectural quality custom signage seamlessly fabricated per design intent drawings.

- A Monument Sign
- B Building ID Letters
- C Bus Entrance ID Letters
- D Dimensional ID Letters
- E Vehicular Directional Sign
- F Garage Clearance Bar
- G Maintenance Area ID Sign
- H Exterior Door ID Plaque
- I Garage Vehicular Directional Sign
- J Corridor Entrance Graphics
- K Bus Lane ID Sign
- L Elevator Lobby Directory
- M Elevator Cab Directory
- N Restroom ID Plaque
- O Stair ID Plaque
- P Loading Dock ID Numeral/Text
- Q General Room ID Plaque
- R Office ID Plaque
- S Bus Bay Entrance Graphic
- T Site Regulatory Sign
- U Administration Area Graphic
- V Building Graphic
- W Dimensional Letters

2.2 METALS

- A. Metal letterforms
 - 1. Fabricated letters from aluminum shall be heliarc welded in conformance with the American Welding Society and the Aluminum Association's specifications. Metal shall be 3003H14 or 60601 alloy.
 - 2. Fabricated letters shall be braced internally where necessary to be free from waves, buckles, or warps.

2.3 ACCESSORIES:

- A. Anchors and fasteners:
 - 1. Anchors, inserts or fasteners shall be compatible with sign materials, shall not result in galvanic action or chemical interaction of adhesives and shall have demonstrable and sufficient strength for intended use.

2. Anchors and fastenings for aluminum shall be stainless steel, zinc or cadmium coated steel. Anchors and fasteners shall be concealed where possible. Indicate locations on shop drawings.
3. Anchors and fastenings for exterior use shall be galvanized steel in accordance with ASTM A153-82.
4. Wherever possible, anchors to concrete and masonry shall be cast-in-place. Use expansion shields where anchors cannot be located before concrete is poured.
5. Fasteners to solid masonry and concrete shall be one of the following:
 - a. flat-head drop-in expansion bolts.
 - b. Powder-actuated fasteners; appropriate size drive pin for concrete and for masonry.
 - c. Fasteners to cells of hollow masonry shall be drive pins of the appropriate size.
 - d. Fasteners to roll or formed steel members shall be powder-actuated fasteners of the appropriate size.
 - e. Fasteners to metal deck shall be self-drilling, self-tapping screws.
 - f. Expansion shields shall be machine bolt type, tubular type, or self-drilling tubular type.
6. Anchor bolts for wood blocking to concrete and masonry shall be the appropriate size steel for masonry, unless otherwise noted, and installed with washer and nut at both ends.
7. Anchor bolts for wood blocking to steel members shall be appropriate size steel and installed with washer and nut.
8. Install using miscellaneous anchors and fasteners as required to secure work in place.

2.4 COATINGS (PAINTS):

- A. Paint and colors to be finalized in 100% submittal
- B. Refer to manufacturers standards for paint finishes and preparation

PART 3 EXECUTION

3.1 INSPECTION

A. Inspection of substrates:

1. Surfaces to receive identifying devices shall be free from defects and imperfections that would prevent an acceptable installation.
2. Commencing of work in any space shall constitute acceptance by the Contractor of surfaces to receive identifying devices as being in a satisfactory condition to permit an acceptable installation. If the Contractor's inspection of such surfaces discloses unsatisfactory conditions, he shall notify the Architect in writing and await further instruction; otherwise, no claims will be considered for unsatisfactory work due to real or alleged faulty surfaces.

3.2 PREPARATION AND PROTECTION:

- A. Protect the work and adjacent work and materials against damage during progress of work until completion. Drop cloths of paper or plastic shall be used around all areas where paint is being applied and appropriate precautions shall be taken to prevent overspray, hazardous conditions or damage to adjacent work.

3.3 INSTALLATION, APPLICATION:

- A. Installation of sign panels and graphic units:
 - 1. Erect, mount or install all panels and units to be level, plumb and true.
 - 2. Use sufficient concealed fasteners and anchors to hold sign panels and graphic units in place. Use only concealed shims. Visible fasteners may only be used where approved in shop drawings or as part of an intentional design detail.
 - 3. Make Architect aware of conflicts in sign locations as shown in the drawings.
 - 4. Mount all room identification sign panels at 60" AFF to centerline of sign and 2" from latch-side door jamb.

3.4 ADJUSTING, CLEANING AND PROTECTION:

- A. Remove and replace damaged identifying devices with new identifying devices free of defects.
- B. Clean exposed surfaces promptly after completion of installation in accordance with recommendations of manufacturer.
- C. Clean exposed metal work with cleanser recommended by manufacturer of materials and rinse with clean water. Do not use harsh chemicals or abrasive. Surfaces with stains which cannot be removed by cleaning shall be refined or replaced to the satisfaction of Architect at no extra cost to Using Agency.
- D. Signs shall be free of tape, packing paper, dirt, smudges, and other foreign material.
- E. Spatters, drippings, smears, and / or spray shall be completely removed.
- F. Plastic surfaces shall be cleaned upon completion in accordance with manufacturer's instructions. Supply one pint of manufacturer's recommended cleaner for Using Agency's use.
- G. Touch up work after installation shall be performed by the sign manufacturer and approved by Architect.
- H. Protection:
 - 1. Work in progress shall be protected at all times from staining, scratching, chipping or other damage until acceptance by the Architect.
 - 2. Provide final protection in a manner acceptable to the fabricator and installer until Date of Substantial Completion.

3.5 SIGN QUANTITIES AND UNIT PRICING




- A. Provide ITEMIZED bid including shipping, delivery, installation, etc.
- B. Provide unit costs good for up to 1 year in the event of additions or re-orders.

3.6 SIGN LOCATIONS AND MESSAGES:

- A. Refer to sheets AS100 – AS103 for Sign Location Plans. A preliminary draft of the corresponding sign messages is provided in the attached Sign Message Schedule.
- B. Refer to sheet AS201 and AS202 for typical sign face layouts, materials, fabrication notes and installation conditions.




END OF SECTION 10 1400

SignMessageSchedule






| NUMBER | SIGN TYPE | MESSAGE |
|--------|-----------|--|
| 001 | A | (monument sign) |
| 002 | E |  Visitor Parking <hr/> Service Drive |
| 003 | T | STOP |
| 004 | T | STOP |
| 005 | D | (message TBD) |
| 006 | E |  Buses <hr/>  Employee Parking |
| 007 | T | DO NOT ENTER |
| 008 | T | END ONE WAY |
| 009 | T | END ONE WAY |
| 010 | T | DO NOT ENTER |
| 015 | T | STOP |
| 016 | T | SECURITY PARKING ONLY |
| 017 | T | NO PARKING ANY TIME |
| 018 | T | SECURITY PARKING ONLY |
| 019 | T | YEILD |

Sign Message Schedule






Page 2

| NUMBER | SIGN TYPE | MESSAGE |
|--------|-----------|---|
| 020 | T | YEILD |
| 021 | T | 8'- 2" LOW CLEARANCE AHEAD |
| 022 | T | STOP |
| 023 | E |  Employee Parking  Visitor Parking Service Drive |
| 024 | T | STOP HERE FOR PEDESTRIANS |
| 025 | T | STOP HERE FOR PEDESTRIANS |
| 026 | E |  Visitor Entrance |
| 027 | T | VISITOR PARKING ONLY |
| 028 | T | VISITOR PARKING ONLY |
| 029 | T | VISITOR PARKING ONLY |





Sign Message Schedule

| NUMBER | SIGN TYPE | MESSAGE |
|--------|-----------|---|
| 030 | T |  HANDICAPPED PARKING PERMIT REQUIRED <hr/> VIOLATORS WILL BE FINED MIN \$150 <hr/> VAN ACCESSIBLE |
| 031 | T | BEGIN ONE WAY |
| 032 | T | BEGIN ONE WAY |
| 033 | T | NO PARKING ANY TIME |
| 034 | T |  HANDICAPPED PARKING PERMIT REQUIRED <hr/> VIOLATORS WILL BE FINED MIN \$150 <hr/> VAN ACCESSIBLE |
| 035 | T | ONE WAY  |
| 036 | T | ONE WAY  |
| 037 | T | ONE WAY  |
| 101 | F | DO NOT ENTER |
| 102 | F | CLEARANCE: 8'- 2" |

Sign Message Schedule



| NUMBER | SIGN TYPE | MESSAGE |
|--------|-----------|--|
| 103 | I | <u>side A:</u>  Exit <u>side B:</u> Exit  |
| 104 | I | <u>side A:</u> (blank) <u>side B:</u> Exit  |
| 105 | J | OPERATIONS |
| 106 | Q | LIVE LOAD 150 psf <div>Sign added November 17, 2014 per owner request</div> |
| 107 | O |  STAIRS (grade II braille) <div>INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS</div> |
| 108 | L | (elevator directory - message TBD) |
| 109 | M | (elevator cab directory - message TBD) |
| 110 | D | EMPLOYEE PARKING |
| 111 | T |  HANDICAPPED PARKING PERMIT REQUIRED <hr/> VIOLATORS WILL BE FINED MIN \$150 <hr/> VAN ACCESSIBLE |

Sign Message Schedule


| NUMBER | SIGN TYPE | MESSAGE |
|--------|-----------|--|
| 112 | T |  HANDICAPPED PARKING PERMIT REQUIRED <hr/> VIOLATORS WILL BE FINED MIN \$150 <hr/> VAN ACCESSIBLE |
| 113 | T |  HANDICAPPED PARKING PERMIT REQUIRED <hr/> VIOLATORS WILL BE FINED MIN \$150 <hr/> VAN ACCESSIBLE |
| 114 | T |  HANDICAPPED PARKING PERMIT REQUIRED <hr/> VIOLATORS WILL BE FINED MIN \$150 <hr/> VAN ACCESSIBLE |
| 115 | O |  STAIRS (grade II braille) |
| 116 | L | (elevator lobby directory - message TBD) |
| 117 | M | (elevator cab directory - message TBD) |
| 118 | J | MAINTENANCE |

Sign Message Schedule

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| NUMBER | SIGN TYPE | MESSAGE |
|--------|-----------|--|
| 119 | I | <u>side A:</u> Exit → <u>side B:</u> (blank) |
| 120 | I | <u>side A:</u> (blank) <u>side B:</u> Exit ↑ |
| 121 | I | <u>side A:</u> Exit → <u>side B:</u> ← Exit |
| 122 | F | CLEARANCE: 8'- 2" |
| 123 | F | DO NOT ENTER |
| 124 | T |  HANDICAPPED PARKING PERMIT REQUIRED <hr/> VIOLATORS WILL BE FINED MIN \$150 <hr/> VAN ACCESSIBLE |
| 125 | T |  HANDICAPPED PARKING PERMIT REQUIRED <hr/> VIOLATORS WILL BE FINED MIN \$150 <hr/> VAN ACCESSIBLE |

Sign Message Schedule

| NUMBER | SIGN TYPE | MESSAGE |
|--------|-----------|---|
| 126 | I | <u>side A:</u> (blank) <u>side B:</u> Exit ↑ |
| 127 | I | <u>side A:</u> (blank) <u>side B:</u> Exit ↑ |
| 128 | I | <u>side A:</u> Exit → <u>side B:</u> (blank) |
| 129 | O |  STAIRS (grade II braille) |
| 130 | Q | LIVE LOAD 150 psf <u>Sign added November 17, 2014 per owner request</u> |
| 131 | Q | LIVE LOAD 150 psf <u>Sign added November 17, 2014 per owner request</u> |
| 132 | Q | LIVE LOAD 150 psf <u>Sign added November 17, 2014 per owner request</u> |
| 147 | Q | LIVE LOAD 100 psf <u>Sign added November 17, 2014 per owner request</u> |
| 148 | Q | LIVE LOAD 150 psf <u>Sign added November 17, 2014 per owner request</u> |
| 149 | Q | LIVE LOAD 100 psf <u>Sign added November 17, 2014 per owner request</u> |
| 150 | C | BUSES |
| 151 | Q | LIVE LOAD 150 psf <u>Sign added November 17, 2014 per owner request</u> |
| 152 | H | (message TBD) |
| 153 | Q | (room identification - message TBD) (grade II braille) |
| 154 | Q | (room identification - message TBD) (grade II braille) |

Sign Message Schedule

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| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|--|---|
| 155 | Q | (room identification - message TBD) (grade II braille) | |
| 156 | R | A101 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 157 | Q | ELECTRICAL A102A (grade II braille) | |
| 158 | R | FILE ROOM A116 (grade II braille) (changeable name insert) | |
| 159 | Q | COMMUNICATIONS A102B (grade II braille) | |
| 160 | Q | TRAINING STORAGE A115A (grade II braille) | |
| 165 | Q | ELECTRICAL A102A (grade II braille) | |
| 166 | R1 | CONFERENCE/ TRAINING (grade II braille) (In Use / Vacant) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 167 | N |  MEN (grade II braille) | |
| 168 | R | STREET SUPERVISOR A114 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 169 | Q | JANITOR A118 (grade II braille) | |

Sign Message Schedule

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| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|--|---|
| 170 | R | PARATRANSIT SUPERVISOR A113 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 171 | N |  WOMEN (grade II braille) | |
| 172 | Q | A106A (grade II braille) | |
| 174 | Q | A106A (grade II braille) | |
| 175 | Q | EXERCISE ROOM A105 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 180 | Q | QUIET ROOM A106 (grade II braille) | |
| 181 | Q | CALL CENTER A112 (grade II braille) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 182 | Q | ELEVATOR MACHINE B1 (grade II braille) | |
| 183 | Q | STORAGE A111A (grade II braille) | |
| 184 | Q | LOST & FOUND A111 (grade II braille) | |
| 185 | V | (Conn. State seal) | |
| 186 | V | WATERBURY MAINTENANCE | |
| 187 | L | (elevator lobby directory - message TBD) | |

Sign Message Schedule



| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|--|
| 188 | O |  STAIRS (grade II braille) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 189 | O |  STAIRS (grade II braille) | |
| 190 | Q | DISPATCH A110 (grade II braille) | |
| 191 | H | A108 | |
| 192 | Q | RADIO ROOM A110A (grade II braille) | |
| 193 | Q | LIVE LOAD 100 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 200 | K | 9 | Rigid ceiling-mount |
| 201 | K | 8 | Rigid ceiling-mount |
| 202 | K | 7 | Rigid ceiling-mount |
| 203 | K | 6 | Rigid ceiling-mount |
| 204 | K | 5 | Rigid ceiling-mount |
| 205 | K | 4 | Rigid ceiling-mount |
| 206 | K | 3 | Rigid ceiling-mount |
| 207 | K | 2 | Rigid ceiling-mount |
| 208 | K | 1 | Rigid ceiling-mount |
| 209 | K | 1 | Rigid ceiling-mount |
| 210 | K | 2 | Rigid ceiling-mount |
| 211 | K | 3 | Rigid ceiling-mount |
| 212 | K | 4 | Rigid ceiling-mount |
| 213 | K | 5 | Rigid ceiling-mount |
| 214 | K | 6 | Rigid ceiling-mount |
| 215 | K | 7 | Rigid ceiling-mount |

Sign Message Schedule

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| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|--|
| 216 | K | 8 | Rigid ceiling-mount |
| 217 | K | 9 | Rigid ceiling-mount |
| 218 | Q | LIVE LOAD 150 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 219 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 220 | Q | (room identification - message TBD) (grade II braille) | <u>Sign added November 17, 2014 per revised floor plan</u> |
| 221 | Q | (room identification - message TBD) (grade II braille) | <u>Sign added November 17, 2014 per revised floor plan</u> |
| 222 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 223 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 224 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 225 | Q | (room identification - message TBD) (grade II braille) | |
| 226 | Q | (room identification - message TBD) (grade II braille) | |
| 227 | L | (elevator lobby directory - message TBD) | |
| 228 | Q | (room identification - message TBD) (grade II braille) | |
| 229 | H | (message TBD) | |
| 230 | O |  STAIRS (grade II braille) | |
| 231 | Q | (room identification - message TBD) (grade II braille) | |
| 232 | Q | (room identification - message TBD) (grade II braille) | |
| 233 | Q | (room identification - message TBD) (grade II braille) | |

Sign Message Schedule



| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|---|
| 234 | Q | (room identification - message TBD) (grade II braille) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 235 | H | (message TBD) | |
| 236 | H | (message TBD) | |
| 237 | R | (office identification - message TBD) (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 238 | N |  MEN (grade II braille) | |
| 239 | Q | (room identification - message TBD) (grade II braille) | |
| 240 | Q | (room identification - message TBD) (grade II braille) | |
| 241 | N |  WOMEN (grade II braille) | |
| 242 | Q | (room identification - message TBD) (grade II braille) | |
| 243 | Q | (room identification - message TBD) (grade II braille) | |
| 244 | Q | (room identification - message TBD) (grade II braille) | |
| 245 | Q | (room identification - message TBD) (grade II braille) | |
| 246 | Q | (room identification - message TBD) (grade II braille) | |
| 247 | Q | (room identification - message TBD) (grade II braille) | |
| 248 | Q | (room identification - message TBD) (grade II braille) | |

Sign Message Schedule


| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|---|
| 249 | Q | (room identification - message TBD) (grade II braille) | |
| 250 | H | (message TBD) | |
| 251 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 252 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 253 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 254 | Q | (room identification - message TBD) (grade II braille) | |
| 255 | R | (office identification - message TBD) (grade II braille) (changeable name insert) | |
| 256 | R | (office identification - message TBD) (grade II braille) (changeable name insert) | |
| 257 | Q | (room identification - message TBD) (grade II braille) | |
| 258 | H | (message TBD) | |
| 259 | P | 1 | |
| 260 | H | (message TBD) | |
| 261 | P | 2 | |
| 262 | Q | (room identification - message TBD) (grade II braille) | |
| 263 | R | (office identification - message TBD) (grade II braille) (changeable name insert) | |
| 264 | Q | (room identification - message TBD) (grade II braille) | |
| 265 | Q | (room identification - message TBD) (grade II braille) | |

| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|---|
| 266 | N |  RESTROOM (grade II braille) | |
| 267 | Q | (room identification - message TBD) (grade II braille) | |
| 268 | Q | (room identification - message TBD) (grade II braille) | |
| 269 | P | 3 | |
| 270 | P | 4 | |
| 271 | H | (message TBD) | |
| 272 | P | 5 | |
| 273 | H | (message TBD) | |
| 274 | H | (message TBD) | |
| 275 | H | (message TBD) | |
| 276 | P | 6 | |
| 277 | Q | (room identification - message TBD) (grade II braille) | |
| 278 | Q | (room identification - message TBD) (grade II braille) | |
| 279 | Q | (room identification - message TBD) (grade II braille) | |
| 280 | H | (message TBD) | |
| 281 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 282 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 283 | Q | LIVE LOAD 150 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 284 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 285 | K | 9 | Rigid ceiling-mount |
| 286 | K | 8 | Rigid ceiling-mount |
| 287 | K | 7 | Rigid ceiling-mount |

Sign Message Schedule


| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|---|
| 288 | K | 6 | Rigid ceiling-mount |
| 289 | K | 5 | Rigid ceiling-mount |
| 290 | K | 4 | Rigid ceiling-mount |
| 291 | K | 3 | Rigid ceiling-mount |
| 292 | Q | LIVE LOAD 150 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 293 | Q | STORAGE S104 (grade II braille) | |
| 294 | Q | S100 (grade II braille) | |
| 295 | H | (message TBD) | |
| 296 | S | A | |
| 297 | S | B | |
| 298 | Q | (room identification - message TBD) (grade II braille) | |
| 299 | O |  STAIRS (grade II braille) | |
| 300 | Q | S102 (grade II braille) | |
| 301 | Q | S103 (grade II braille) | |
| 302 | Q | JANITOR S114 (grade II braille) | |
| 303 | N |  RESTROOM (grade II braille) | |
| 304 | Q | ELECTRICAL S106 (grade II braille) | |
| 305 | Q | S101 (grade II braille) | |

Sign Message Schedule





| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|---|
| 306 | R | S107 (grade II braille) (changeable name insert) | |
| 307 | Q | LIVE LOAD 150 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 308 | Q | S108 (grade II braille) | |
| 309 | Q | UREA ROOM S109 (grade II braille) | |
| 310 | Q | LUBE ROOM S110 (grade II braille) | |
| 311 | S | B | |
| 312 | S | A | |
| 313 | Q | SERVICE S111 (grade II braille) | |
| 314 | H | (message TBD) | |
| 315 | H | (message TBD) | |
| 316 | O |  STAIRS (grade II braille) | |
| 317 | G | (maintenance area identification sign) | Wall-mount |
| 318 | G | (maintenance area identification sign) | Wall-mount |
| 319 | G | (maintenance area identification sign) | Wall-mount |
| 320 | G | (maintenance area identification sign) | Wall-mount |
| 321 | G | (maintenance area identification sign) | Wall-mount |
| 322 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 323 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 324 | G | (maintenance area identification sign) | Wall-mount |
| 325 | G | (maintenance area identification sign) | Wall-mount |
| 326 | I | Exit ↓ | |

| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|--|---------------------|
| 327 | I | Exit ↓ | |
| 328 | G | (maintenance area identification sign) | Wall-mount |
| 329 | G | (maintenance area identification sign) | Wall-mount |
| 330 | G | (maintenance area identification sign) | Wall-mount |
| 331 | G | (maintenance area identification sign) | Wall-mount |
| 332 | G | (maintenance area identification sign) | Wall-mount |
| 333 | G | (maintenance area identification sign) | Wall-mount |
| 334 | G | (maintenance area identification sign) | Wall-mount |
| 335 | G | (maintenance area identification sign) | Wall-mount |
| 336 | G | (maintenance area identification sign) | Wall-mount |
| 337 | G | (maintenance area identification sign) | Wall-mount |
| 338 | G | (maintenance area identification sign) | Wall-mount |
| 339 | G | (maintenance area identification sign) | Wall-mount |
| 340 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 341 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 342 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 343 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 344 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 345 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 346 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 347 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 348 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 349 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 350 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 351 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 352 | G | (maintenance area identification sign) | Rigid ceiling-mount |
| 353 | G | (maintenance area identification sign) | Wall-mount |
| 354 | G | (maintenance area identification sign) | Wall-mount |
| 355 | G | (maintenance area identification sign) | Wall-mount |
| 356 | G | (maintenance area identification sign) | Wall-mount |

Sign Message Schedule

| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|---|
| 357 | G | (maintenance area identification sign) | Wall-mount |
| 358 | G | (maintenance area identification sign) | Wall-mount |
| 359 | G | (maintenance area identification sign) | Wall-mount |
| 360 | G | (maintenance area identification sign) | Wall-mount |
| 361 | Q | LIVE LOAD 150 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 362 | Q | LIVE LOAD 250 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 375 | I | No Exit | |
| 376 | I | No Exit | |
| 377 | B | WATERBURY MAINTENANCE | |
| 378 | W | INFORMATION | |
| 418 | Q | LIVE LOAD 100 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 419 | Q | LIVE LOAD 100 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 420 | V | (bus symbol) | |
| 421 | L | (elevator directory - message TBD) | |
| 423 | O |  STAIRS (grade II braille) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 424 | R1 | CONFERENCE A202 (grade II braille) (In Use / Vacant) | |
| 425 | Q | LIVE LOAD 100 psf | <u>Sign added November 17, 2014 per owner request</u> |
| 426 | R | A203 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 427 | R | A204 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |

| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|---|---|
| 428 | R | A205 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 429 | R | A206 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 430 | R | A207 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 431 | R | A208 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 432 | Q | WORK ROOM A223 (grade II braille) | |
| 433 | R | A209 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 434 | R | A210 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 435 | R | A211 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 436 | Q | STORAGE A224 (grade II braille) | |
| 437 | Q | LUNCH ROOM A212 (grade II braille) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 438 | Q | (room identification - message TBD) (grade II braille) | |
| 439 | Q | JANITOR A226 (grade II braille) | |

| NUMBER | SIGN TYPE | MESSAGE | |
|--------|-----------|--|---|
| 440 | O |  STAIRS (grade II braille) | |
| 441 | Q | ELECTRICAL A225 (grade II braille) | |
| 442 | Q | COMMUNICATIONS A213 (grade II braille) | |
| 443 | Q | WORK ROOM A223 (grade II braille) | |
| 444 | N |  WOMEN (grade II braille) | |
| 445 | R | A215 (grade II braille) (changeable name insert) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 446 | Q | A216 (grade II braille) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 447 | N |  RESTROOMS (grade II braille) | |
| 448 | N |  MEN (grade II braille) | |
| 449 | Q | A217 (grade II braille) | INSTALL 1/16" THICK BACKING PANEL ON OPPOSITE SIDE OF GLASS TO MATCH SIGN DIMENSIONS |
| 450 | R | A218 (grade II braille) (changeable name insert) | |

Sign Message Schedule

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| NUMBER | SIGN TYPE | MESSAGE |
|--------|-----------|--|
| 451 | R | A219 (grade II braille) (changeable name insert) |
| 452 | U | (artwork TBD) |
| 453 | U | (bus symbol) |
| 454 | L | (elevator lobby directory - message TBD) |

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2490 Pa).
- B. Related Sections:
 - 1. Division 01, High Performance Buildings Requirements Section 018113.13 for credits 16a-38k-4(b)4, 16a-38k-4(b)5.
 - 2. The above listed HPB credits are related to this section. Other HPB credits may apply and shall be reviewed for their potential applicability and conformed with as though listed.

1.2 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula $\text{Btu} \times \text{in./h} \times \text{sq. ft.} \times \text{deg F}$ or $\text{W/m} \times \text{K}$ at the temperature differences specified. Values are expressed as Btu or W.

1.3 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 ACTION SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For duct liner and sealing materials.
- C. Shop Drawings: Show details of the following:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating pressure classifications and sizes on plans.
 - 3. Fittings.
 - 4. Reinforcement and spacing.
 - 5. Seam and joint construction.

6. Penetrations through fire-rated and other partitions.
 7. Terminal unit, and coil, installations.
 8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- D. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
1. Ceiling suspension assembly members.
 2. Other systems installed in same space as ducts.
 3. Ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
 4. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- F. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.5 QUALITY ASSURANCE SUBMITTALS

- A. Welding Certificates: Copies of certificates indicating welding procedures and personnel comply with requirements in "Quality Assurance" Article.

1.6 QUALITY ASSURANCE

- A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports; AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members; and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.
- C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.
- D. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.
- E. Mockups: Before installing duct systems, erect mockups representing system pressure classifications higher than 2-inch wg (500 Pa). Build mockups to comply with the following requirements, using materials indicated for completed Work:
1. Locate mockups in the locations and of the size indicated or, if not indicated, as directed by

Architect. Mockup may be a representative section of the actual duct system.

2. Include the minimum number of each of the following features and fittings:
 - a. Five transverse joints.
 - b. One access door.
 - c. Two typical branch connections, each with at least one elbow.
 - d. Two typical flexible duct or flexible connector connections for each duct and apparatus.
3. Perform tests specified in “Field Quality Control” Article. Modify mockup construction and perform additional tests as required to achieve specified minimum acceptable results.
4. Obtain Engineer’s approval of mockups before starting Work.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work. When directed, demolish and remove mockups from Project site.
6. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.7 QUALITY ASSURANCE SUBMITTALS

- A. Manufacturer’s Certification Letter in accordance with NOTICE TO CONTRACTOR – POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle sealant and firestopping materials according to manufacturer’s written recommendations.
- C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.

- C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 DUCT LINER

- A. General: Comply with NFPA 90A or NFPA 90B and NAIMA's "Fibrous Glass Duct Liner Standard."
- B. Materials: ASTM C 1071 with coated surface exposed to airstream to prevent erosion of glass fibers.
 - 1. Thickness: 1 inch (25 mm).
 - 2. Thermal Conductivity (k-Value): 0.26 at 75E F (0.037 at 24E C) mean temperature.
 - 3. Fire-Hazard Classification: Maximum flame-spread rating of 25 and smoke-developed rating of 50, when tested according to ASTM C 411.
 - 4. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and ASTM C 916.
 - 5. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
 - a. Tensile Strength: Indefinitely sustain a 50-lb- (23-kg-) tensile, dead-load test perpendicular to duct wall.
 - b. Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch (3 mm) into airstream.
 - c. Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.3 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is limited to materials of adhesive or mastic nature.
 - 1. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 66 percent solids.
 - 2. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.4 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.
 - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs

more than 4 inches (100 mm) thick.

2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
 2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
 3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.5 RECTANGULAR DUCT FABRICATION

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
 2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- B. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
1. Supply Ducts: 3-inch wg (750 Pa).
 2. Return Ducts: 2-inch wg (500 Pa), negative pressure.
 3. Exhaust Ducts: 2-inch wg (500 Pa), negative pressure.
- C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.

2.6 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness are prohibited.

- B. Apply adhesive to liner facing in direction of airflow not receiving metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liners in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).
- G. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely around perimeter; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or “Z” profile or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - 1. Fan discharge.
 - 2. Intervals of lined duct preceding unlined duct.
 - 3. Upstream edges of transverse joints in ducts.
- I. Secure insulation liner with perforated sheet metal liner of same metal thickness as specified for duct, secured to ducts with mechanical fasteners that maintain metal liner distance from duct without compressing insulation.
 - 1. Sheet Metal Liner Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.
- J. Terminate liner with duct buildouts installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire-damper sleeve.

2.7 ROUND AND FLAT-OVAL DUCT FABRICATION

- A. General: Diameter as applied to flat-oval ducts in this Article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat-oval duct.
- B. Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA’s “HVAC Duct Construction Standards--Metal and Flexible.”
- C. Flat-Oval Ducts: Fabricate supply ducts with standard spiral lock seams or with butt-welded longitudinal seams according to SMACNA’s “HVAC Duct Construction Standards--Metal and Flexible.”
- D. Double-Wall (Insulated) Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner liner. Dimensions indicated on internally insulated ducts are inside dimensions.

1. Thermal Conductivity (k-Value): 0.26 at 75° F (0.037 at 24° C) mean temperature.
2. Outer Shell: Base outer-shell metal thickness on actual outer-shell dimensions. Fabricate outer-shell lengths 2 inches (50 mm) longer than inner shell and insulation, and in metal thickness specified for single-wall duct.
3. Insulation: 1-inch- (25-mm-) thick fibrous-glass insulation, unless otherwise indicated. Terminate insulation where internally insulated duct connects to single-wall duct or uninsulated components. Terminate insulation and reduce outer duct diameter to inner liner diameter.
4. Solid Inner Liner: Fabricate round and flat-oval inner liners with solid sheet metal of thickness listed below:
5. Perforated Inner Liner: Fabricate round and flat-oval inner liners with sheet metal having 3/32-inch- (2.4-mm-) diameter perforations, with an overall open area of 23 percent. Use the following sheet metal thicknesses and seam construction:
 - a. Ducts 3 to 8 Inches (75 to 200 mm) in Diameter: 0.019 inch (0.5 mm) with standard spiral seam construction.
 - b. Ducts 9 to 42 Inches (225 to 1070 mm) in Diameter: 0.019 inch (0.5 mm) with single-rib spiral seam construction.
 - c. Ducts 44 to 60 Inches (1120 to 1525 mm) in Diameter: 0.022 inch (0.55 mm) with single-rib spiral seam construction.
 - d. Ducts 62 to 88 Inches (1575 to 2235 mm) in Diameter: 0.034 inch (0.85 mm) with standard spiral seam construction.
6. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

2.8 ROUND AND FLAT-OVAL SUPPLY AND EXHAUST FITTING FABRICATION

- A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.
- C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate bend radius of die-formed, gored, and pleated elbows one and one-half times elbow diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):

- a. Ducts 3 to 26 Inches (75 to 660 mm) in Diameter: 0.028 inch (0.7 mm).
 - b. Ducts 27 to 36 Inches (685 to 915 mm) in Diameter: 0.034 inch (0.85 mm).
 - c. Ducts 37 to 50 Inches (940 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
 - d. Ducts 52 to 60 Inches (1320 to 1525 mm) in Diameter: 0.052 inch (1.3 mm).
 - e. Ducts 62 to 84 Inches (1575 to 2130 mm) in Diameter: 0.064 inch (1.6 mm).
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg (500 to 2490 Pa):
 - a. Ducts 3 to 14 Inches (75 to 355 mm) in Diameter: 0.028 inch (0.7 mm).
 - b. Ducts 15 to 26 Inches (380 to 660 mm) in Diameter: 0.034 inch (0.85 mm).
 - c. Ducts 27 to 50 Inches (685 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
 - d. Ducts 52 to 60 Inches (1320 to 1525 mm) in Diameter: 0.052 inch (1.3 mm).
 - e. Ducts 62 to 84 Inches (1575 to 2130 mm) in Diameter: 0.064 inch (1.6 mm).
 4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal seam flat-oval duct.
 5. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material-handling classes A and B; and only where space restrictions do not permit using 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.
 6. Round Elbows, 8 Inches (200 mm) and Smaller: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
 7. Round Elbows, 9 through 14 Inches (225 through 355 mm): Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees, unless space restrictions require a mitered elbow. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
 8. Round Elbows, Larger Than 14 Inches (355 mm), and All Flat-Oval Elbows: Fabricate gored elbows, unless space restrictions require a mitered elbow.
 9. Die-Formed Elbows for Sizes through 8 Inches (200 mm) and All Pressures: 0.040 inch (1.0 mm) thick with two-piece welded construction.
 10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
 11. Flat-Oval Elbow Metal Thickness: Same as longitudinal seam flat-oval duct specified above.
 12. Pleated Elbows for Sizes through 14 Inches (355 mm) and Pressures through 10-Inch wg (2490 Pa): 0.022 inch (0.55 mm).

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

- A. Drawings indicate general arrangement of ducts, fittings, and accessories. Provide all required fittings,

accessories and ancillaries as required for a complete system as determined by the Engineer.

- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round and flat-oval ducts in lengths not less than 12 feet (3.7 m), unless interrupted by fittings.
- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Refer to other sections for fire and smoke damper specifications as well as fire stopping specifications.
- O. For exposed duct to be painted, maintain clean, grease, oil and dirt free. Coordinate scheduling of priming and painting of ductwork prior to installation.

3.2 UNDERSLAB DUCT INSTALLATIONS

- A. Verify undamaged conditions of duct before enclosure with fill or encasement.
- B. Install underslab ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and as indicated.
- C. Protect ducts from damage by equipment used in placing concrete on or around ducts.
- D. Protect duct openings.

3.3 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Pressure Classification Less Than 2-Inch wg (500 Pa): Transverse joints.
- C. Seal externally insulated ducts before insulation installation.

3.4 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16 feet (5 m) and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install concrete inserts before placing concrete.
- F. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3.5 CONNECTIONS

- A. Connect equipment with flexible connectors according to other Sections.
- B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.6 FIELD QUALITY CONTROL

- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
- B. Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
- C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.
- D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg (500 to 2490 Pa).

- E. Remake leaking joints and retest until leakage is less than maximum allowable.
- F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.7 ADJUSTING

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Detailed procedures for Testing, Adjusting, and Balancing are specified in other Sections.

3.8 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION 233113